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EXAMINER

TRAN, NHAN T

ART UNIT PAPER NUMBER

2615

DATE MAILED: 09/03/2003

13

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary

Application No.

09/299,874

Applicant(s)

HASHIMOTO ET AL.

Examiner

Nhan T. Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 July 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-82 is/are pending in the application.
- 4a) Of the above claim(s) 37-82 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-36 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 April 1999 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 7,8,9,10.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Drawings

1. Figures 40 – 42 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

2. Claim 13 is objected to because of the following informalities: the claim recites the limitation "the photoelectric conversion element" in lines 14-15 of page 70. There is insufficient antecedent basis for this limitation in the claim.

Claim 29 is objected to because of the following informalities: the claim recites the limitation "the photoelectric conversion element" in lines 19-20 of page 74. There is insufficient antecedent basis for this limitation in the claim.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1 – 4, 7, 10 – 18 & 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Takahashi (US 5,955,753).

Regarding claim 1, Takahashi discloses an image sensing apparatus having a plurality of unit cells, each including a plurality of photoelectric conversion elements (pixels 30-11, 30-12, 30-21, 30-22, so on) and a common circuit (circuit of MOS transistors 4, 5, 6 and floating diffusion FD 21 or circuit of MOS transistors 7-12 and 14) shared by the plurality of photoelectric conversion elements, arranged in either one or two dimensions, wherein the plurality of photoelectric conversion elements are arranged at a predetermined interval (see Figs. 1 & 2; col. 3, line 56 – col. 4, line 14 wherein each unit cell shown in Fig. 2 contains two pixels).

Regarding claim 2, Takahashi also shows that the plurality of photoelectric conversion elements in each unit cell are arranged side by side in one direction, and the common circuit

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(circuit of MOS transistors 4, 5 & 6) is arranged at the edge (via FD 21 of n+ well) of each plurality of photoelectric conversion elements (1) (see Fig. 2).

Regarding claim 3, the plurality of photoelectric conversion elements in each unit cell are arranged side by side in one direction, and the common circuit is arranged between adjoining unit cells arranged in a direction perpendicular (at FD 21 of n+ well) to the direction of the arrangement of said plurality of photoelectric conversion elements (see Figs. 1 & 2 wherein the common circuit of MOS transistors 4, 5 & 6 is always connected perpendicularly to the pixels).

Regarding claim 4, the common circuit is arranged at the edge of each plurality of photoelectric conversion elements arranged in a horizontal direction (see Fig. 1 wherein the common circuit is arranged at the right edge in view of rows).

Regarding claim 7, the common circuit is also arranged at the edge of each plurality of photoelectric conversion elements arranged in a vertical direction (see Fig. 1 wherein the common circuit is also arranged at the right edge in view of columns).

Regarding claim 10, Takahashi further discloses noise reading means (8, 10 operated by timing T_N) for reading a noise of the common circuit (see Fig. 1; col. 4, lines 31-35); First signal reading means for reading first signal (e.g., output from pixel 30-11) through the common circuit; second signal reading means for reading a second signal (e.g., output from pixel

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30-21) through the common circuit; and noise reduction means for reducing the noise from the first and second signals (see Figs. 1 & 3; col. 4, line 36 – col. 5, line 9).

Regarding claim 11, the noise reduction means is differential means (see col. 4, line 65 – col. 5, line 9).

Regarding claim 12, Takahashi shows that the first signal is read from one of the plurality of photoelectric conversion elements (e.g., 30-11) in each unit cell, and the second signal is read from another photoelectric conversion element (e.g., 30-21) in the same unit cell (see col. 5, lines 2-9 & lines 62 – 65 for independent readout of pixels).

Regarding claim 13, Takahashi also discloses the first signal is read from one (30-11 of the first line) of the plurality of photoelectric conversion elements in each unit cell, and second signal is read from the photoelectric conversion element (30-31) and another photoelectric conversion element (30-21) in the same unit cell (see col. 6, lines 40-49).

Regarding claim 14, the claimed limitations are analyzed with respect to claim 10.

Regarding claim 15, the claimed limitations are analyzed with respect to claim 11.

Regarding claim 16, the claimed limitations are analyzed with respect to claim 12.

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Regarding claim 17, the common circuit (5 or 14) is an amplifier for amplifying and outputting a signal from each of the plurality of photoelectric conversion element (see Fig. 1; col. 3, lines 60-61 and col. 5, lines 5 – 9).

Regarding claim 18, the common circuit further includes transfer means (3) for transferring signal from each of the plurality of photoelectric conversion element and reset means (4) for resetting the common circuit (see Figs. 1 & 2; col. 3, lines 59-60).

Regarding claim 20, the common circuit (circuit of MOS transistors 7-12 and 14) is clearly a signal processing circuit (see col. 4, line 36 – col. 5, line 15 wherein the dark current or noise is removed during the signal processing).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 21 – 34 & 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi (US 5,955,753) in view of Watanabe (US 6,522,356).

Regarding claim 21, the claimed limitations are analyzed in claim 1. In addition, Takahashi further discloses photoelectric conversion elements, out of the plurality of photoelectric conversion elements, which are covered by a color filter (G) that contributes mostly to forming a luminance signal arranged in a same interval both horizontal and vertical directions (see Fig. 6; col. 6, lines 58-60 for the mosaic color filter pattern implemented for the image sensing apparatus).

Takahashi does not teach the pixels corresponding to color filters (G) to forming luminance signals, which are arranged in rows or columns, are shifted from each other. However, such pixel and color filter arrangement for an image sensor is well known in the art to obtain a balanced color components of an image as disclosed by Watanabe in Fig. 19A-B; col. 2, lines 49-55.

Therefore, it would have been obvious to one of ordinary skill in the art to recognize the well-known pixel and color arrangement for an image sensor in which the pixels corresponding to color filters arranged in rows or columns to forming luminance signals are shifted from each other to obtain an image having balanced color components.

Regarding claim 22, the joining rows of the photoelectric conversion elements covered by G filters are shifted by $3/2$ pitches from each other (see col. 2, lines 49-52).

Regarding claim 23, Takahashi shows the plurality of photoelectric conversion elements in each unit are arranged on both sides of the common circuit (see Fig. 2 for the pixels arranged on both side of the common circuit at floating diffusion 21).

Regarding claim 24, a color filter for covering one of the plurality of photoelectric conversion elements arranged on one side of the common circuit contributes for forming a luminance signal, and a color filter covering another photoelectric conversion element arranged on the other side of the common circuit contributes to forming a color signal (see Takahashi in Fig. 1 for odd rows, e.g., a row of 30-11 & 30-12 and so on, and even rows, e.g., a row of 30-21 & 30-22 and so on, wherein the common circuit is arranged between the odd and even rows. Further, see Watanabe in Fig. 19; col. 2, lines 49-52, wherein a color signal is represented by R or B).

Regarding claim 25, Takahashi discloses that the image sensing apparatus further comprises signal processing means for forming a luminance signal and a color difference signal on the basis of signals obtained from the plurality of photoelectric conversion elements (see col. 6, lines 30-33).

Regarding claim 26, the claimed limitations are analyzed with respect to claim 10.

Regarding claim 27, the claimed limitations are analyzed with respect to claim 11.

Regarding claim 28, the claimed limitations are analyzed with respect to claim 12.

Regarding claim 29, the claimed limitations are analyzed with respect to claim 13.

Regarding claim 30, the claimed limitations are analyzed with respect to claim 10.

Regarding claim 31, the claimed limitations are analyzed with respect to claim 11.

Regarding claim 32, the claimed limitations are analyzed with respect to claim 12.

Regarding claim 33, the claimed limitations are analyzed with respect to claim 17.

Regarding claim 34, the claimed limitations are analyzed with respect to claim 18.

Regarding claim 36, the claimed limitations are analyzed with respect to claim 20.

5. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi (US 5,955,753) in view of Fossum et al (US 6,021,172).

Regarding claim 19, Takahashi does not expressly teach that the common circuit includes an A/D converter. As taught by Fossum, it is desirable to reduce the number of circuits included in each pixel so that pixel area for pixel aperture or spatial resolution for the image sensor are increased by utilizing a semi-parallel architecture, where an A/D converter is shared by plurality of pixels (see Fig. 6; col. 6, lines 25-40).

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Therefore, it would have been obvious to one of ordinary skill in the art to implement the semi-parallel architecture of A/D converter as taught by Fossum for the common circuit in Takahashi in order to increase pixel aperture or spatial resolution for the image sensor.

6. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi (US 5,955,753) in view of Watanabe (US 6,522,356) and in further view of Fossum et al (US 6,021,172).

Regarding claim 35, Takahashi and Watanabe do not teach that the common circuit includes an A/D converter. As taught by Fossum, it is desirable to reduce the number of circuits included in each pixel so that pixel area for pixel aperture or spatial resolution for the image sensor are increased by utilizing a semi-parallel architecture, where an A/D converter is shared by plurality of pixels (see Fig. 6; col. 6, lines 25-40).

Therefore, it would have been obvious to one of ordinary skill in the art to implement the semi-parallel architecture of A/D converter as taught by Fossum for the common circuit in Takahashi in order to increase pixel aperture or spatial resolution for the image sensor.

7. Claims 5 & 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi (US 5,955,753).

Regarding claim 5, Takahashi teaches that unit cell is configured with a plurality of pixels each including a photoelectric conversion element as shown in Figs. 1 & 2. Although,

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Takahashi does not show a detailed MOS layout for the unit cell in which the number of horizontal conductors passing over each pixel is the same, it is obvious that the number of horizontal conductors should be the same in order to maintain a consistent number of conductors passing over each pixel so that spatial areas of each pixel and spatial areas among unit cells are uniformly and consistently distributed to reduce manufacturing errors and to increase signal integrity for an image sensor.

Therefore, it would have been obvious to one of ordinary skill in the art to realize the consistency and uniformity in MOS circuit layout in which a number of horizontal conductors passing over each pixel is maintained the same to reduce manufacturing errors and to increase signal integrity for an image sensor.

Regarding claim 8, the claimed limitations are analyzed with respect to claim 5.

8. Claims 6 & 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi (US 5,955,753) in view of Nakashiba (US 5,442,396).

Regarding claim 6, Takahashi teaches unit cell being configured with a plurality of pixels each including a photoelectric conversion element as shown in Figs. 1 & 2. Takahashi does not expressly teach that contacts between layers of each pixel are arranged so that a number of conductors passing over each unit cell, as well as one of the contacts which not connected to a conductor passing over the unit cell in connected to a light-shield film of the pixel. However, as taught by Nakashiba, light shield film of each pixel is formed between the photoelectric

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conversion sections and vertical charge transfer regions and connected to plurality of conductors passing over plurality of pixels, wherein contacts between layers of each pixel is established by contact holes (27) so that readout characteristics for signal charges from photoelectric converting sections are improved (see Figs. 6 & 7A-D and Abstract; col. 3, lines 3-60. It is noted that contact holes 27 are power feeds to the power layer of each pixel).

Therefore, it would have been obvious to one of ordinary skill in the art to modify Takahishi with Nakashiba so that contacts between layers of each pixel as well as one of other contacts which is not connected to a conductor is connected to a light-shield film of the pixel in order to improve readout characteristics.

Regarding claim 9, the claimed limitations are analyzed with respect to claim 6.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nhan T. Tran whose telephone number is (703) 605-4246. The examiner can normally be reached on Monday - Thursday, 8:00am - 6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew B Christensen can be reached on (703) 308-9644. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 306-0377.

NT.

A handwritten signature in black ink, appearing to read 'Andrew Christensen', is written over a horizontal line.

ANDREW CHRISTENSEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600